

# GAS CONTAMINATION EFFECTS ON PULSE TUBE PERFORMANCE

J. L. **Hall** and R. G. Ross  
Jet Propulsion Laboratory  
California Institute of Technology  
Pasadena, CA., USA 91109

Experiments were **performed** to **quantify** the effect of contaminants in the helium **working** gas of a typical pulse tube **cryocooler** operating down to 40 K. Known amounts of nitrogen, water, carbon dioxide and argon were added to the helium gas in the pulse tube and the effect on thermodynamic performance measured. The contaminant levels of these gases ranged from 25 to 500 ppm in various combinations. The pulse tube gas also was monitored for any other species that might have outgassed from the interior pulse tube surfaces over time. A quadrupole mass spectrometer with a closed ion source was used to measure gas composition to a resolution of approximately one part per million. Various calibration gas standards were used to “ensure the accuracy of the mass spectrometer. Preliminary results indicate that pulse tube performance is only weakly sensitive to nitrogen and water contamination in the 50 to 100 ppm range.

**Jeffery** L. Hall  
JPL  
4800 Oak Grove Dr.  
157-316  
Pasadena, CA 91109  
email:

Phone: (818) 354-1531  
FAX: (81 8) 393-4206

Prefer Paper  
[jlhall@pop.jpl.nasa.gov](mailto:jlhall@pop.jpl.nasa.gov)